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Physical Observations of Saturn in 1887.

By Thomas Gwyn Elger.

The following observations of the planet were made with an 8½-in. silver-on-glass reflector by Calver during the months of February, March, and April.

12th February, 9ʰ to 10ʰ. Good definition; East wind. Planet beautifully defined with a power of 350. *Rings.*—A. No trace of any division; outer border slightly darker than the remainder. B. Inner edge very dark. Ring gradually increasing in brightness to about midway between the interior and exterior borders. Outer half uniformly bright. C. Both ansæ extremely dark, hardly distinguishable except where it crosses the ball; here it is sufficiently transparent to allow the latter to be seen through it. *Belts.*—The broad equatorial belt is orange-yellow in colour, and sharply defined on its northern edge by a darker band of varying width. Its southern limits are marked by a much fainter band, the intervening space exhibiting a mottled appearance—due to the presence of light spots and markings. About midway between the bluish-grey polar cap and the equatorial zone there is a faint belt, but this region is very indistinct. *Shadow of ball.*—The *f* side of the sharply-defined shadow on B appears to be concave up to Cassini's division, where there is a well-marked notch, apparently coincident with the latter. South of this, on ring A, the shadow follows the curvature of the ball, and seems to be somewhat narrower than any portion of the shadow on ring B. The south limb of the ball is slightly within the outer edge of A.

16th February, 8ʰ to 9ʰ. Frosty; wind N.E. Definition variable—not so good as on the 12th. Powers used, 284, 350. *Rings.*—A. Is similar in colour to the polar cap—viz. greyish-blue. There is an evident though faint light line concentric with the ring about midway between the outer and inner edge, but rather nearer the former. It can be traced for some distance on both ansæ, but is more easily seen on the *p* side. B. The shading on this ring becomes gradually lighter from the inner edge to a point about ¼th the apparent width of the belt from the outer edge, where it suddenly ceases, the remainder of the ring being uniformly bright. C. Dark, but distinct on *p* side. *f* ansa nearly indistinguishable. *Belts* less favourably seen than on the 12th.

21st February, 9ʰ to 9ʰ 30ᵐ. Definition variable. Power used, 350. *Rings.*—A. No trace of any detail. B. The bright outer edge appears to be of the same tone, but slightly more brilliant than the central portion of the ball immediately north of the equatorial belt. C. Both ansæ very dusky—scarcely distinguishable, except here and there. *Belts.*—North border of equatorial belt sharply defined. Mottled surface evident. Polar and intermediate zone indistinct. *Shadow of ball.*—As on the 12th

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25*th February*, 9^h to 9^h 30^m. Definition on the whole favourable. Power used, 350. *Rings.*—A. No detail seen; inner edge, adjoining Cassini's division, on *p* ansa somewhat darker than the general surface. B. As on the 21st. C. *p* ansa very obscure, in places as dark as the space between the ball and the ring system. Nothing abnormal was noted in connection with the *f* ansa, though at times the *n f* part of the ring seemed to be lighter than the remainder. *Belts.*—All badly defined.

26*th February*, 8^h 30^m to 9^h 30^m. Clear frosty night with good definition. Powers used, 284, 350. *Rings.*—A. No detail visible. B. Gradually increasing in brightness from the inner to the outer edge, which is bounded by a narrow zone of uniform brilliancy about equal in width to Cassini's division. C. With both eyepieces the *p* ansa exhibits on its inner border three or four large re-entering angles like the teeth of a saw, the intervening spaces being apparently as dark as that between the ball and the ring, and extending nearly to the outer edge of the ring. This appearance is confined to the western section of the ansa, there being nothing abnormal as regards the *s p* and *n p* portion of it. The *f* ansa is dark but traceable. *Belts.*—Details well seen.

27*th February*, 9^h to 9^h 30^m. Definition variable. Powers used, 284, 350. *Rings.*—A. Light line visible for some distance on both ansæ, as on the 16th inst. Inner edge slightly darker than the rest of the surface. B. As on the previous evening. C. The indented edge of the *p* ansa cannot be made out, but the surface of the ring is unequally dark. At times of best definition two or three dark areas are noted upon it with both eyepieces.

28*th February*, 9^h to 9^h 30^m. Sky hazy. Good definition, affording some exquisite glimpses of the planet. Power used, 350. *Rings.*—A. Light streak seen on both ansæ, as on the 16th and 27th. C. Very dusky, only isolated areas of the *p* ansa visible. *Belts.*—Equatorial belt covered with ill-defined detail, and bounded on the north by a wide band, much darker than any other portion of the ruddy zone. Faint belt on the northern hemisphere visible near the east and west limb. The greater portion of it is hidden by the ring C, to which it is about equal in tone.

12*th March*, 8^h 30^m to 9^h 30^m. Definition variable. Wind E. Powers used, 284, 350. *Rings.*—A. No detail visible. C. *p* ansa is very evidently broken up into several areas of different degrees of darkness, so that, except a short section of it, *n p*, it is impossible to recognise it as a ring surrounding the planet. The *f* ansa, on the contrary, is easily visible. *Belts.*—All fairly distinct. *Shadow of ball.*—The southern limb and outer edge of A are apparently coincident, and the shadow south of the well-marked notch at Cassini's division becomes gradually wider as it approaches the boundary of the ring.

13*th March*, 8^h 30^m to 9^h 15^m. Frosty; E. wind. Definition variable. Powers used, 284, 350. *Rings.*—A. A faint dark line, presumably Encke's division, seen on the widest part of both ansæ. B. Inner edge very obscure, ring gradually increases in brilliancy to a point about $\frac{1}{3}$rd its apparent width from its outer edge, where it becomes suddenly bright. C. At times it is impossible to recognise any traces of this ring on the *p* side, though the *f* ansa is obvious enough. During the best definition, however, three or four large dusky areas are just distinguishable amid the general blackness of the space between the ball and the *p* ansa of B. *f* ansa very dark, but traceable. *Belts.*—Details well seen. *Shadow of ball.*—Extremely sharp; notch very evident; shadow falling on B slightly concave towards the east, becoming gradually wider from the notch to the outer edge of A.

16*th March*, 8^h 15^m to 9^h 15^m. Frosty; E. wind. Definition variable, but at times excellent, affording superb views of the planet. Powers used, 284, 350. *Rings.*—A. When seen to the greatest perfection it seems to be of a lavender-grey hue, the *p* ansa being slightly darker and the *f* ansa much darker than the dusky northern edge of the equatorial belt. Encke's division is seen on the *p* side only; here it is an easy object, and can be followed for some distance round the ansa. During the most favourable glimpses both ansæ appear to be striated with faint concentric markings. B. The brilliant outer edge of this ring causes it apparently to stand up like a step in front of Cassini's division. The graduated shading is not so evident to-night. It seems to occupy about $\frac{2}{3}$rds of the width of the ring. C. The anomalous appearance of the *p* ansa again observed with both eyepieces. *f* ansa dark, but easily seen. *Belts.*—Equatorial zone covered with minute white spots on an orange-yellow background, and exhibiting much ill-defined detail. Its northern boundary consists of a dark band of irregular width, with a sharply-defined edge towards the north. The southern limit of the zone is marked by a similar but much fainter band. Polar cap, bluish-grey. A suspicion of two or three finer belts between this and the equatorial zone. About midway between the latter and the most northerly belt (which is partially hidden by C) there is a faint band, which at 9^h extended from the eastern limb across nearly three-fourths of the visible disc. That portion of the ball between the equatorial zone and C is much brighter and more decidedly yellow than the brightest part of the ring-system, viz. the outer portion of B.

18*th March*, 8^h to 9^h. Wind E. Definition excellent. Powers used, 284, 350. *Rings.*—A. Encke's division steadily seen on both ansæ, and occasionally glimpsed all round the ring, though it is more distinct on the *p* ansa than elsewhere; here it is bordered on the inner side by a faint narrow light edge. B. As on March 16th. C. The anomalous condition of the *p* ansa very evident with both eyepieces; as on February 26th, it

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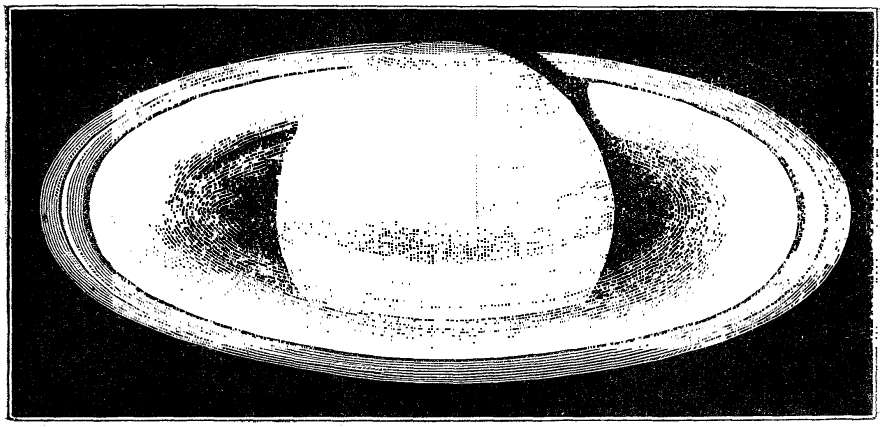
exhibits a deeply jagged or indented edge, while there is a wide black space on the *s p* side concentric with B and adjoining it.* *f* ansa very obscure, but visible. *Belts.*—All the detail seen on the 16th inst. observed to great perfection. Faint band north of equatorial zone again visible, but it could only be clearly traced from the east limb to the centre.



Saturn, 18 March, 1887, 8h to 9h. Thos. Gwyn Elger.

24th March, 9h to 10h. Definition not good. Power used, 350. *Rings.*—A. No detail visible. C. Irregular outline of inner border in *p* ansa traceable, but ring very dark and indistinct. *f* ansa apparently normal, but very obscure.

7th April, 9h to 9h 30m. Definition variable—very good at times. Powers used, 284, 350. *Rings.*—A. No detail visible. C. The unsymmetrical inner border of the *p* ansa very conspicuous and remarkable as exhibiting a scalloped edge. The boundary between this ansa and B very ill-defined—so much so that it is difficult, as regards the *s p* portion, to trace any definite line of demarcation. *f* ansa very dark, hardly distinguishable from the space between ball and ring. *Belts.*—All well seen. Faint belt north of equatorial zone glimpsed once or twice on the *f* side of the centre. *Shadow of ball.*—Notch at Cassini's division seems decidedly blunter than it did a fortnight ago. The outer border of the shadow on A now runs up to the extreme point of the notch. The outline of the shadow both on A and B is evidently concave towards the east.

10th April, 8h 20m to 9h 10m. Wind E. Definition variable, but at times excellent. Powers used, 284, 350, and 420. *Rings.*—A. No detail seen. B. As on 16th March. C. Irregular inner border of *p* ansa evident with all the eyepieces used, and a dark interval between C and B extending for some distance on either side the apparent major axis of the ring. Three or four dusky spots noticed on the surface of *f* ansa. These features satisfactorily seen with all powers. *Belts.*—Details finely seen, but no trace of delicate belt north of equatorial zone, observed on March 16th and 18th and on 7th April. *Shadow of ball.*—As the notch now projects very little beyond the outline of the shadow, it is very difficult to make out.

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* See accompanying drawing.

11*th April*, 8^h 30^m to 8^h 55^m. Definition variable. Fine clear night; wind E. Powers used, 284, 350. *Rings.*—A. No detail seen. C. Irregular border glimpsed several times on *p* ansa. *f* ansa very obscure.

14*th April*, 8^h 30^m to 9^h 0^m. Definition excellent. Wind N.E. Powers used, 284, 350, 420. *Rings.*—A. Encke's division steadily seen on both ansæ. B. As on 16th March. C. With all the eyepieces the inner edge of the *p* ansa is clearly serrated. Dark spots again visible on *f* ansa. *Belts.*—Beautifully distinct; faint belt north of equatorial zone, first seen on 16th March, traced from limb to limb.

20*th April*, 8^h 20^m to 9^h 0^m. Definition pretty good. Powers used, 284, 350. *Rings.*—A. No detail visible. C. Both ansæ very dark. Irregular border of *p* ansa evident. The surface of ring in *f* ansa is manifestly irregular in tone, though no definite spots can be distinguished.—*Belts* not favourably seen. *Shadow of ball.*—It requires some attention to see the notch this evening; even at times of best definition there is hardly a recognisable projection at the Cassini division.

After this date, though several observations were attempted, the increasing duration of twilight and unfavourable weather prevented the details of the planet from being seen to advantage.

Kempston, Beds:
1887, *June* 6.

On an old Engraving of Jupiter. By Captain W. Noble.

The other day, in the valuable library of old astronomical works belonging to my friend Mr. C. Leeson Prince, F.R.A.S., I came across a curious little volume, described on its title-page as "Atlas Cœlestis, containing the Systems and Theoryes of the Planets, the Constellations of the Starrs. Sold by Ben Bragg in Paternoster Row." Neither the author's name nor the date of publication is appended; but the name of "John Seller" appears in the corner of one of the plates, and, from a note in the body of the work with reference to an eclipse, it must have been published in 1680. Presumably this is the same John Seller who was the author of a quarto treatise on navigation which appears in the catalogue of our own library, and who produced a variety of books on arithmetic, astronomy, and navigation between the years 1671 and 1711. My immediate object, however, is to invite attention to one of Mr. Seller's engravings, which, through the kindness of Mr. Prince, I am able to reproduce in fac-simile.